APPENDIX 5.5B
Prior Geophysical Map and Survey Methods

provide field reference points for the location of geophysical survey points and the elevation of completed water wells. This survey was completed over an approximately 500-foot grid in the western portion of the landfill, and over an approximately 250-foot grid in the eastern portion. The locations and elevations of the survey points are shown on Figure 1. The survey was completed during the week of August 29, 1983, by Rick Engineering.

Further surveying was completed by Rick Engineering during the week of September 26 to determine the elevations of completed water wells. These elevations are reported in Appendix G.

3.2 Geophysical Survey

Two types of geophysical survey techniques, electromagnetic and magnetic, were utilized at the landfill site to obtain information on the presence of metallic objects as potential sources of contamination. This survey was conducted during the period September 1 to September 5, over an approximate 500-foot grid in the western portion, and an approximate 250-foot grid in the eastern 35-acre parcel. Interpretation of the results of the survey is shown on Figure 1 and is discussed in Section 4.2.2. A more detailed description of the survey and of its interpretation is presented in Appendix F.

The locations of the geophysical survey measurements were identified in the field by pre-located wooden stakes, supplemented by spray painted marks on the ground, to provide for repeatable measurements, if necessary, and for the accurate location of borings based on the geophysical results.

3.3 Field Drilling Program

3.3.1 Boring Locations

The locations of the 20 water well and 5 gas well borings for the field investigation were selected as follows:

4.2.2 Current Investigation

In this study 8 borings were placed in the landfill in the 35-acre parcel and 13 borings were placed in the remaining portion of the landfill. The identification of landfill constituents through borings is generally not as descriptive as the identification through test pits and direct observation, because of the relatively small diameter of the auger and of the samples obtained of the landfill material. However, the characterizations obtained during this study appear to be consistent with the previous characterizations. The most commonly identified constituents were newspaper and paper, wood, glass, and wire and metal. Other components that were less frequently identified included cloth, cardboard, plastic, organic debris, rubber, brick, construction debris, oil, and shells. During the drilling operations, no indication was given by the three crews of hitting any materials that might have been barrels in the landfill material; the only case where material was encountered which impeded drilling progress was at Boring No. 12, where a cable was found to have been wrapped around the cutting edge of the auger. A summary of the components identified in these borings is presented in Table 4-2.

TABLE 4-2. LANDFILL CONSTITUENTS IDENTIFIED IN BORINGS
MISSION BAY LANDFILL SITE ASSESSMENT

Landfill Constituent	Frequency of Identification (of 21 borings)
Newspaper & paper	20
Wood	18
Glass	12
Wire & metal	9
Cloth	3
Cardboard	2
Plastic	2
Organic debris	2
Rubber	1
Brick	1
Construction debris	1
Oil	1
Shells	1

The observations from the test pits and borings are consistent with the geophysical surveys which did not indicate significant concentrations of ferrous material within the uppermost 15 to 20 feet. The geophysical measurements did, however, indicate significant quantities of ferrous material just below this depth, in relative concentrations as indicated on Figure 1. An interpretation of these results relative to the presence of barrels is presented in Section 7.2.

4.3 Air Quality Measurements

As noted above in Section 3.3, four types of air quality measuring devices were used at the site to test the quality of air adjacent to samples obtained from the landfill and underlying soil, and the air in the general zone of the borings. These devices included organic vapor analyzers (OVA), a combustible gas-hydrogen sulfide (H_2S) meter, a hydrogen cyanide (HCN) - H_2S alarm, and spot sampling with colorimetric Draeger tubes for carbon tetrachloride (CCl_4), HCN, hydrochloric acid vapors (HCl), benzene (C_6H_6), and vinyl chloride. As noted above in Section 3.3, these air quality testing devices were primarily used to verify the safety of employees at the site and of the public near the site, and should be considered supplemental to the more precise soil, water and gas testing data of the landfill materials presented below in Section 6.

The major conclusion that can be reached from the air quality measurements is that methane was detected during the landfill investigation in concentrations of up to about 0.1 percent in the immediate vicinity of the borehole. The highest concentrations of methane were detected directly over landfill cuttings brought to the surface by the augers, over barrels containing these cuttings prior to disposal, and in borings which were sealed overnight after having been advanced to landfill material above the water table. Based on this information, the borings which indicated the greatest concentrations

APPENDIX F
GEOPHYSICAL MEASUREMENTS

F-1 INTRODUCTION

A geophysical survey was performed at the Mission Bay landfill during the period from September 1 to September 5, 1983. The purpose of the survey was to delineate representative areas having the highest probability of containing metal drums and contamination. Two geophysical techniques were used: Magnetic and electromagnetic (EM). Magnetic readings were obtained at a spacing of 50 feet on a 500-foot grid in the western portion of the landfill, and on a 250-foot grid in the eastern 35-acre parcel. The EM readings were obtained along the same grid and monitored continuously between discrete measurement points spaced 10 feet to 30 feet apart, depending on the variability of the readings. The purpose of the grid was to obtain sufficient representative site coverage to form a basis for assessing overall site conditions. The results of the geophysical surveys are shown on Figure 1.

F-2 MAGNETIC MEASUREMENTS

Magnetic measurements were obtained using an EG&G Geometrics Model 816 magnetometer. The magnetometer was used to assess the presence and magnitude of ferrous metal objects within the instrument's detection range. Magnetic data are interpreted by noting the location and characteristics of readings which are unusual or anomalous with respect to the normal range of values of a site. The size of the magnetic anomaly associated with an object depends on its size, weight, and magnetic moment. A typical metal drum should cause a 20 to 40 nanotesla (nT) or gamma anomaly when buried ten feet deep, a 5 to 10 nT anomaly when buried 20 feet deep, and a 1 to 3 nT anomaly when buried 30 feet deep. The effect of multiple drums is cumulative. Thus, under conditions that could be encountered at the Mission Bay site detection of perhaps a few to several drums buried about 20 feet deep, a 10 to 20 nT anomaly would be expected. In addition, the presence of 10 to 20 drums would normally cause an anomaly of over 100 nT.

The ferrous metal normally present in municipal trash causes variations in the magnetic field which are not necessarily related to drums. Examination of the survey results shows that variations of 15 to 20 nT or more commonly occur between adjacent readings within the confines of the landfill. This also corresponds to the anomaly magnitude expected from the presence of a few to several drums. This level of magnetic variation was considered a "moderate magnetic anomaly" in Figure 1.

Outside the landfill the variation was generally around 5 nT and normally less than 10 nT, identified in Figure 1 as "no significant magnetic anomaly." Variations of 80 to 100 nT, or more, occasionally occur on the site and have been designated in Figure 1 as a "strong magnetic anomaly." This situation would correspond to the presence of a relatively large accumulation of ferrous metal objects or a single large object. An additional category has been designated for areas where conditions could not be fully evaluated due to the shielding caused by near surface metal (generally estimated to be within the upper ten feet). These areas may or may not have deeper metal objects. This last designation is based on the results of the EM survey discussed below.

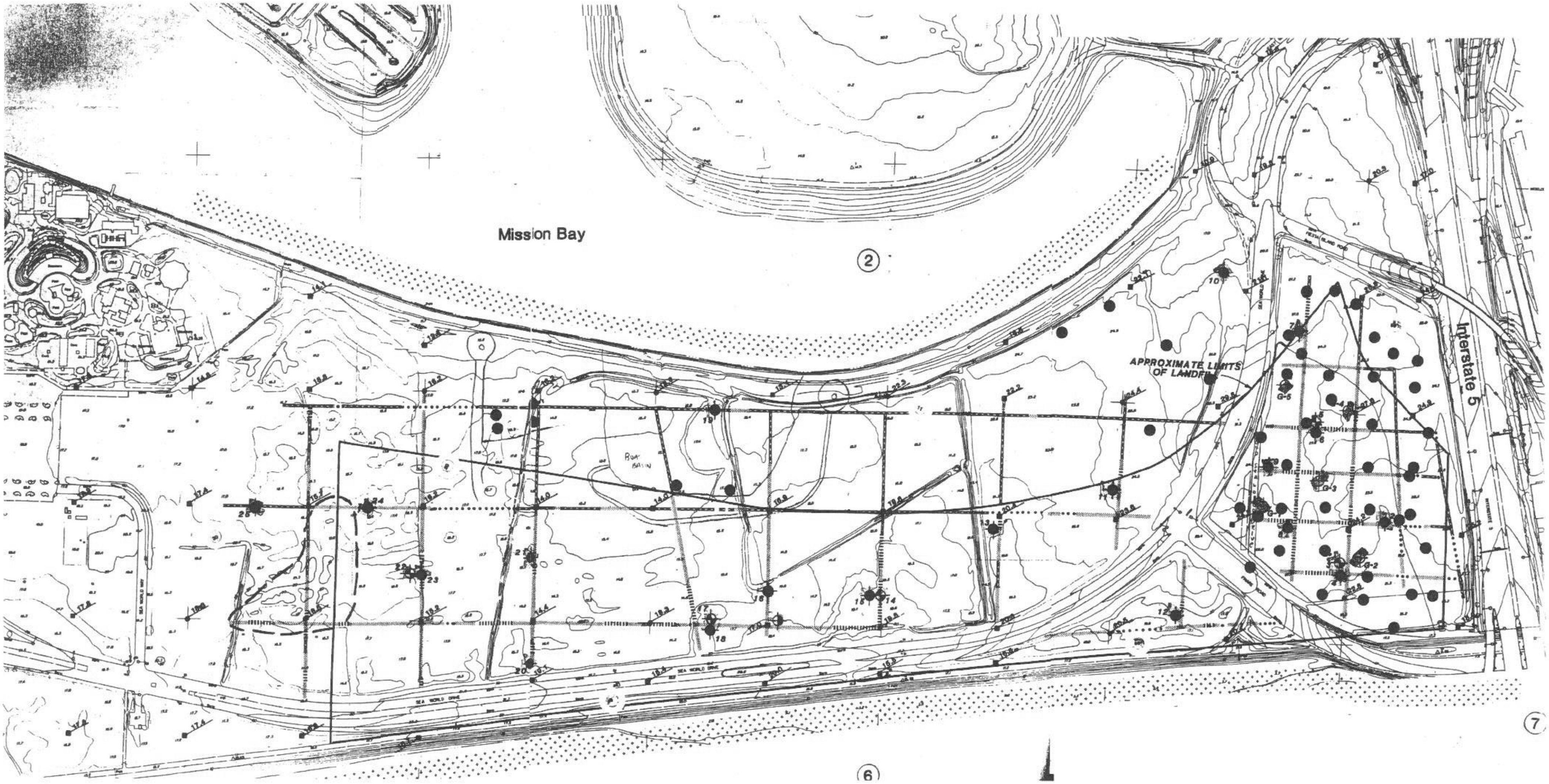
F-3 ELECTROMAGNETIC (EM) MEASUREMENTS

Electromagnetic (EM) measurements were obtained using a Geonics EM31 conductivity meter. The conductivity instrument was used to assess the presence and magnitude of near-surface metal and electrical conductivity variations which might be related to contamination. This instrument was used in its shallow (9 feet) and deep (18 feet) sensing modes. This method measures apparent ground conductivity by sensing the amount of magnetic field coupling between two loop antennas located near the ground. Interpretation is handled in a manner similar to the magnetometer interpretation.

Conductivity variations were generally found to correspond closely with salinity and/or topographic variations. For instance, depressions (often having a salt crust) were related to high conductivity values which would result from the higher salinity and/or the decreased distance to the brackish ground water. These variations were an order of magnitude greater than those variations normally associated with contamination, and therefore the results of the EM survey could not be used to assess contamination.

The EM instrument's response to metal objects was used to evaluate the possible interference to the magnetometer measurements from near-surface ferrous metal trash. The high conductivities found at this site, combined with the background noise created by metallic trash in the landfill, results in an effective reduction in depth of penetration to about 6 feet and 15 feet for the shallow and deep modes, respectively.

The EM measurements when coupled with the magnetometer measurements provide information regarding the depth to ferrous metal. An electrical conductivity anomaly should be in the upper 15 feet (±) whereas a magnetic anomaly without an electrical conductivity anomaly indicates ferrous metal at a deeper depth. Magnetic anomalies also associated with EM anomalies are designated in Figure 1 as a "strong magnetic anomaly less than 15 feet below ground surface" as may just represent near-surface metal. However, deeper metallic objects could still be present and effectively be shielded by the near-surface metal objects.


Interstate 5
Mission Bay
APPROXIMATE LIMITS OF LANDFILL
2
6
7